APPENDIX 4-E

Video Script: "CFIT: An Encounter Avoided"

This video is part of an international industrywide effort to reduce Controlled Flight Into Terrain (CFIT). The Flight Safety Foundation formed a Task Force to produce a CFIT Education and Training Aid. This video is part of that training aid, and it was produced by The Boeing Company.

		(Narrator)
1.	Fade up to still graphics (TBD) of a map of Malaysia. CG: weather plate over map: Wind calm Visibility 6000 meters/misty Sky conditions: 3 Octas surface 6 Octas/4267 meters Temperatur: 23°C/73°F Dew point: 22°C/72°F Altimeter: 1011 hectoPascals 229.86 inHg	**Flight Sixty-Six was a Boeing Seven Forty-Seven cargo flight enroute to Kuala Lumpur, Malaysia.The first officer was flying the approach to runway Three-Three during the pre-dawn darkness. The I-L-S to runway Three-Three was out of service as reported in both the current NOTAMS and arrival ATIS. The crew, after being cleared by ATC to fly a N-D-B approach, misread the descent clearance and is descending to four hundred feet instead of two thousand, four hundred feet.**
2.	Scroll list of most recent accidents listing month, day, year, place, and number of fatalities/injured. (overseas/domestic mix)	**In the first half of the nineteen nineties (1990s), almost <u>two thousand</u> <u>people died</u> in accidents attributed to Controlled Flight Into Terrain! As you can tell, C-F-I-T accidents and incidents can happen anywhere, at any time.**
3.	ADO Build Short shots of GPWS warning, ATC on radar, and flight deck briefing.	**The difference with an incident is that the last link in the chain held. The crew was trained and responded to a GPWS warning...the ATC controller noticed the airplane descending towards terrain... or standard operating procedures were effective. Remember, everyone must be involved!**
4.	C-F-I-T Incident CG over red question mark. Scroll future accidents.	**Because of the international increase in air traffic, C-F-I-T projections for the next twenty years show that if trends continue, we can expect to lose one large airplane, worldwide, to a C-F-I-T accident <u>EVERY OTHER WEEK!!</u>**

21 Dec. 1999 Molokai, HI 117
8 Jan. 2000 Ackh, Inur, Malaysia 52
26 Jan. 2000 Hualien, Taiwan 148
5 Feb. 2000 Everett, WA 79
19 Feb. 2000 Kinshasa, Zaire 129
1 March 2000 Koyuk, AK 56
13 March 2000 Oucalpa, Peru 112
26 March 2000 Paris, France 267
7 April 2000, Portland, OR 146
25 April 2000, Bhartpur, Nepal 86
9 May 2000, Bandung, Indonesia 55
21 May 2000, Tripoli, Libya 245
4 June 2000, Attenrhein, Switzerland 23
17 June 2000, Istanbul, Turkey 152
31 June 2000, Posadas, Argentina 113
16 July, 2000, Juneau, AK 38
22 July, 2000, Cozumel, Mexico 15
3 Aug, 2000, Medan, Indonesia 111
20 Aug 2000 Denver, CO 77
6 Sept 2000 Cucuta, Columbia 245
24 Sept 2000, Rio de Janeiro, Brazil 120

That's twenty-eight airplanes and the hundreds and hundreds of people on them, <u>lost, every year!!</u> These statistics conceal the human sadness, as well as the commercially devastating effects on an air carrier's business.

5. National news broadcast of the small airplane crash on approach to Auburn-Lewiston airport in Maine, 1985, carrying Samantha Smith.

(Network broadcast of plane crash)

6. Location is C-F-I-T site, Hurricane Ridge. Talent starts talking off-screen, then walks into frame.

(On-camera talent)
An accident occurred just at this point. It happened at night.The weather was clear. It was the end of a long duty day. The crew could actually see the landing runway. They died less than five hundred feet from the top of the ridge! Why would pilots fly perfectly good airplanes into the ground?

		This question is at the heart of our investigation into the causes of controlled flight into terrain accidents.
7.	CG over Talent: as a build; **Causes and Contributing Factors** **Avoiding C-F-I-T Traps** **System Solutions** **Training Solutions**	***We're going to show you how pilots can get into a C-F-I-T situation, AND ways to avoid these traps. You'll see how changes to the way the aviation industry does business can improve the way we all think and act about safety.***
8.	Talent walks into frame at Boeing simulator bay.	***Finally, we'll talk about effective approaches to C-F-I-T training. To see what the industry has been doing to reduce C-F-I-T accidents, let's look at some history.***
9.	Old footage of flight decks with early versions of radio altimeter.	***(Narrator)*** **In the late (1960s), as part of the Category Three All Weather Landing System, radio altimeters were installed on many airplanes. For the first time, pilots had a comparatively reliable indication of their height above terrain.**
10.	On a modern flight deck, 737, we see and hear the Ground Proximity Warning System.	**The next major improvement was the Ground Proximity Warning System. Agencies around the world began mandating G-P-W-S for all large airplanes beginning in nineteen-seventy-five (1975).**
11.	Earth shot with calendars and number of fatalities CG over globe.	**In one area of the world, before GPWS was mandated, hull losses for large airplanes were averaging eight a year. With the requirement for GPWS, the C-F-I-T hull loss rate is currently about one every two years. C-F-I-T accidents can be reduced. This is significant because the decline has occurred while the airplane fleet has almost**

	doubled, and the number of flights have tripled!
12. Graphic comes out of globe; "Incidents are still occcuring daily throughtout the world." Yellow dots depict incidents as they build on.	**Don't be misled however by these low accident rates. Incidents that could have resulted in accidents are still occurring daily throughout the world. According to some experts a C-F-I-T incident occurs at least every two weeks even in those areas considered the "safest". GPWS still forms the last safety net. We still have room for improvement.**
13. In flight, crew giving "One Thousand" foot callout.	**Remember, high technology solutions are no substitute for good airline philosophy and flight deck management.**
14. Graphics.	**The International Civil Aviation Organization, I-K-O, mandated the installation of G-P-W-S in the late nineteen-seventies (1970s). However, about three hundred of the world's jet transports still do not have Ground Proximity Warning Systems. This about three percent. This three percent generates <u>fifty percent</u> of C-F-I-T accidents! Not surprisingly, it's also the oldest generations of aircraft that have the highest accident rates.**
15. Approach Control for Seattle-Tacoma International Airport (Auburn) console/screen showing M-S-A-W-S alert. Set up demo of aircraft penetrating minimum safe altitude.	**It's not just G-P-W-S, and the upgrades to it that have reduced C-F-I-T accidents. The installation of altitude reporting systems alerts Air Traffic Controllers by using visual alarms when aircraft penetrates, or is predicted to penetrate, a minimum safe altitude in the terminal area.**

16. ATC personnel at scopes.
Interior flight deck during landing.

While the installation of these systems is limited, the continual investment by air traffic services in expanding and up-grading ATC radar, the minimum safe altitude warning system, along with runway navigational aids and procedures, have all helped reduce the C-F-I-T risk.

17. **Jan Stenberg, President/Chief Operating Officer**
Akira Kondo, President, JAL
Dr. Assad Kotaite, President, Council of ICAO

(On-camera testimony)
Jan Stenberg (SAS)
To solve CFIT problems, we require commitment from all people throughout the aviation industry. We must advocate the safety culture because it is the right thing to do, and besides, it's just good business. In our company, we constantly talk about how to improve safety. It's an obsession with us, and it should be with you. There are no excuses not to provide our customers with the safest air travel possible.

Akira Kondo (JAL)
Solid investment in training is of the greatest significance. Nothing stands still where safety is concerned, and although operational circumstances are constantly changing, safety will always be the key element in our planning. All of Japan Airlines people are dedicated to safety. That is our mission.

	Dr. Assad Kotaite (ICAO) **Full implementation of the GPWS requirements and of the Controlled Flight Into Terrain prevention program are essential in order to meet the objective of fifty per-cent reduction in the global Controlled Flight Into Terrain accident rate by the year 1998.**
18. Video clip from Windshear and TCAS CG titles: **"Windshear Avoided, What the Crew Can Do."** **"Traffic Alert and Collision Avoidance System" (TCAS)**	**The commitment that aviation industry showed in the effort against the problems of windshear and mid-air collisions shows our efforts can make a difference"**
19. Graphic.	**Accident fatalities used to be divided between C-F-I-T, midair collisions, windshear, and "other." Of these, Controlled Flight Into Terrain accounted for less than one half of the total.**
20. Graphic build from scene 19.	**Here's what we can do when we work together. By the end of the 1980's, increased awareness and improvements in training, along with new technology such as TCAS and windshear detection have reduced midair collision and windshear accidents, and they almost disappear from the charts.**
21. Graphic continues from scene 20. Builds to reflect C-F-I-T.	**But look what happened to C-F-I-T! It grew to eighty-one percent (81%)!**
22. On-camera narrator.	***(On-camera talent)*** **Why are C-F-I-T accidents so difficult to prevent?? One factor is just human nature.**

23. DVE of talking faces sliding along and through frame. Each quote is from a different pilot.	***(On-camera sound bites)*** ***"I'll see it coming and know what to do".*** ***"I'd never make that kind of mistake"*** ***"I've never flown in weather that's too bad."*** ***"I've always found the runway."*** ***"Did I ever NOT know my position? Well, I'd never admit that!"*** ***"I've been flying that route for years. And I know my airplane. It's the most modern one in the fleet. It'll never happen to me!"***
24. Nightime view of aircraft on approach coming out of clouds. Cut to Astro of 757 at dusk.	***(Narrator)*** **Well, it does happen. Given the right chain of events, C-F-I-T could happen to any of us.** **One constant in all of these accidents is that outside visibility was limited, or the accident occurred at night. The terrain could not be seen easily...until just before impact!**
25. In fog/out fog.	
26. MS of airplane on approach.	**C-F-I-T accidents have occurred on departures as well as on missed approaches. However, most of the recent C-F-I-T accidents and incidents occurred during nonprecision approaches and landings. Let's look at the position and vertical profile of these accidents in relationship to the landing runway.**
27. Graphic (chart build finishes from scene 26).	**This chart shows the vertical path of these events. Notice how stable many of these vertical paths are... right into the ground!**

28. Graphic.

Almost <u>all</u> are on the runway center line <u>inside</u> of fifteen miles.

29. On-camera testimony of pilot from inside flight deck.

(On-camera testimony)
Each C-F-I-T accident has ultimately been held to be the pilot's responsibility. The pilot had the <u>last chance</u> to save the aircraft.

30. Interview with decision maker.
Sir Colin Marshall,
British Airways
Gordon Bethune, President/Chief Operating Officer,
Continental Airlines
David Hinson,
FAA Administrator

(On-camera testimony)
Sir Colin Marshall (British Airways)
We believe that the danger of Controlled Flight Into Terrain will be reduced only through much greater awareness of contributory factors and commitement to taking necessary action to eliminate them. This involves investment in the right technology, with strict adherence to optimum operating procedures; comprehensive, effective pilot training; and acceptance of the vital need for an open, incident-reporting culture.

Gordon Bethune (Continental Airlines)
Hello, I'm Gordon Bethune, President and Chief Executive of Continental Airlines, and also a Boeing-trained 757-767 pilot, so I think I know something about Controlled Flight Into Terrain and the value of technology and safety and how all that runs into a company's bottom line. I gotta tell you that here at Continental, safety is an important investment. You can't pay enough attention to putting the right investment in the right place, and Controlled Flight Into Terrain is an issue that I think every airline needs to address. I hope yours does too.

	David Hinson (FAA) **I urge everyone, airlines, operators, pilots, and crewmembers, to become aware of the dangers of C-F-I-T and to make sure that they've had the training, and they have the equipment, to help avoid this dangerous situation. Safe flying to you all.**
31. Still photo of CFIT accident (van).	**Let's look at some of the major factors affecting C-F-I-T accident rates and the traps they can present. Then you'll see some of the solutions the international aviation community recommends.**
32. Graphic turns red and title up: **CFIT Contributing Factors**	**Accidents have many contributing factors. Investigators always reveal a chain of events that may even reach back to support organizations.**
33. Graphic from above with CG: **Lack of Vertical Awareness**	***(Narrator)*** **Two-thirds of all C-F-I-T are a direct result of altitude error or lack of vertical situational awareness.**
34. Citation climbing in clouds; lay in TRACON audio for radar vectors: **Lack of Vertical Awareness**	**Pilots must remain aware of terrain when accepting radar vectors. Some believe that A-T-C will provide obstacle clearance while enroute off airways. This is not true! Remember, the pilot is ultimately responsible for obstacle clearance.**
35. Graphic of Azores accident of 707.	**For example, in one accident, if the crew had known where they were and understood that the clearance they received would take them below the Minimum Enroute Altitude, the aircraft would not have struck the mountain just ten feet below the crest.**

36. Return to Graphic build: **Pilot-ATC (Communication errors)** Video of pilot on headset. CG: Language differences: **Lack of Standarized Phraseology** **Readback errors** **Heavy workloads**	**Some communication errors and misunderstandings are due to language differences, lack of standardized phraseology, readback errors, or heavy workloads.**
37. Graphic build (continued): **Approach and Departure Procedures** Video of aircraft flying, audio of ATC giving vectors.	**Radar vectors force pilots to rely on A-T-C controllers for terrain avoidance. However, the pilots must retain vertical situational awareness while under radar vectors.**
38. Graphic build (continued): **Altimeter (setting)** Record audio of British ATC giving altimeter setting.	**Barometric altimeter settings errors remain a problem. There have been cases where pilots use the wrong standard for the area.** ***(Weather forecast in foreign accent)*** **"CURRENT WEATHER IS TWO OCTAS AT TWELVE HUNDRED, FIVE OCTAS AT THREE THOUSAND, WIND TWO NINER ZERO AT TWELVE, GUST TWENTY, ALTIMETER NINER NINER EIGHT."**
39. CU of setting altimeter in inches and hectoPascals.	**For example, if pilots set inches of mercury instead of hectoPascals, it can eventually result in large errors in the altitude indicated on altimeters.**
40. Graphic build (continued): **Navigational (errors)** CG: **Disorientation** **Improper Transition** **Selecting Wrong Nav Aid** **Lack of Horizontal Situational Awareness**	**Cases of navigational errors involve disorientation with respect to the nav aid, improper transition on approach, selecting the wrong nav aid, or just plain lack of horizontal situational awareness.**

41. Graphic build (continued):
Autoflight (misuse)
WS of 777 FFS. Slow push to CU of EADI-EHSI.

Today's modern airplanes have sophisticated flight directors, autopilots, autothrottles, and flight management systems. These devices make significant contributions to the overall safety of flight.

42. CU of FMC in sim.

But remember, these are only machines that follow instructions. They're smart, but they don't think! They do whatever is asked of them... even if it's wrong.

43. MS of MCU, finger pushing.
LNAV engaged.

When commanded, they will unerringly follow your instructions straight into the ground! Each crew member must ensure that both vertical and horizontal modes are correct and engaged. Treat autopilots like inexperienced crewmembers. Cross-check them constantly!

44. Graphic build (continued):
CG:
Other Misinterpreting display range marks
Procedure Errors
Data Base Errors
Barometric Pressure Anomalies

Other factors include misinterpreting display range marks, procedure errors, database errors, or barometric pressure anomalies.

45. Lack of vertical awareness
Pilot-ATC communication errors
Approach and departure procedures
Altimeter setting
Navigation errors
Autoflight misuse
Other

In the accident you're about to see, many of the factors we just described occurred. As you watch this re-creation, see if you can *identify* these factors.

(Recreation of Flying Tigers accident)

(Last three minutes of Flying Tigers re-creation)

46. CG bullets during Flying Tigers (at "OK, 4.0.0"):
    1. **Pilot-ATC communication error**

    CG at "You got 2-5-5....":
    2. **Navigational Errors**

    CG at "You by there 3-20-9":
    3. **Lack of Vertical Awareness**

    CG at "You're alright, just...":
    4. **Lack of Vertical Awareness**

47. Talent on camera/sim bay.

(On-camera talent)
This crew failed to react to eight G-P-W-S warnings. Why did the crew get into this situation? One of the solutions to the C-F-I-T problem is proper training. Let's look at a training situation in the simulator where crews learn to avoid C-F-I-T as well as perform the escape maneuver.

48. WS inside simulator with crew and instructor pilot doing nonprecision approach.

Before takeoff the crew completed a departure review and briefing. Here we see them as they are going through the approach briefing.

49. Scene continues.
    CG:
    Situational Awareness

The common thread running through C-F-I-T accidents is situational awareness. This includes not only horizontal awareness, knowing where you are over the ground, but vertical awareness as well.

50. WS inside simulator,Talent is checking approach charts.
    CG:
    Situational Awareness
    - **Study approach charts**

Approach charts should be studied before leaving cruise altitude. Key fixes and airport elevation must be noted and associated with terrain and obstacles along the approach path. Pilots should have a good understanding of both approach and departure design criteria in order to fully

	understand the obstacle clearance margins built into them.
51. CU of colored chart.	**Some Captains have spent hours studying a first-time approach into a terrain critical airport. Terrain and obstructions should be studied using a chart that shows elevation contours, preferably a chart with color.**
52. WS of sim (insert RMDI swinging). Add audio of Beacon. Crew calls out "1000 feet." CG: **Situational Awareness** • **Know altitude and distance from airport** • **Cross-check altitudes with charts**	**Know your altitude and distance from the landing airport. Cross-check the altitudes with the approach charts or enroute maps. Understand that <u>you</u> are responsible for knowing this information, not the A-T-C controller.**
53. CU of EHSI.	**Most modern airplanes use electronic displays that show your position. This information is a great help. But remember, errors can occur.**
54. MCU of round dial (steam gage). HSI. CG: **Situational Awareness** • Study approach acharts • Know altitude & distance from airport • Crosscheck altitudes with charts • **Check nav radios**	**Make sure that the navigational radios are properly set. Several C-F-I-T accidents have occurred because the pilot was flying an instrument approach while the navigational radios were incorrectly tuned.**
55. CU of FMC (sim).	**If your airplane has a flight management computer, make sure it is correctly programmed. Each pilot should independently verify the information entered into the computer.**

56. Simulator scene continued: MCUs of VOR/DME CUs (out before auto enagage). CG: **Situational Awareness** Study approach charts • Know altitude and distance from airport • Cross-check altitudes with charts • Check nav radios • **Monitor raw data**	**During the approach, the pilots must carefully monitor both raw data from the V-O-R, D-M-E, or N-D-B, and information from the barometric and radio altimeter.**
57. Add CG: **Use all data to assist you**	**Use every available aid to assist you in knowing your position and the recommended altitude at that position.**
58. Graphic of Approach plate with old glide path; then overlay with new glide path.	**Hazards exist using low descent quadrant or step-down approaches. When authorized, a continuous descent angle of approximately three degrees is an effective way to fly a stabilized nonprecision approach.**
59. Simulator scene continued: CU of each pilot talking about approach. CG: **Stabilized Approach**	**Studies show that one of the common factors in C-F-I-T accidents is the lack of a stabilized approach. Operators considered the safest in the business all have procedures about when an approach must be stabilized and what the crew should do if it is not.**
60. MS of stack of manuals. CG: **Standard Operating Procedures**	**These same operators also have wel-defined standard operating procedures.**

61. Simulator scene continues: MCUs of pilots talking to each other. We hear some sound bites of conversation.
CG:
Situational Awareness
- Study approach acharts
- Know altitude and distance from airport
- Cross-check altitudes with charts
- Check nav radios
- Use all data to assist you
- Stabilized approach
- **Communication**

Communication is the key. Each pilot must have situational awareness to ensure the final descent path is correct. If any flight deck member is unsure, ...execute a missed approach.

62. Long shot of sim bay; Talent walking down bay, turns and enters classroom.

One of the solutions to the C-F-I-T problem is classroom instruction and simulator training for the crews. Training needs to include not only C-F-I-T causes and traps, but recovery as well.

63. DVE slide to briefing room. Instructor is just completing a neatly printed (TV safe) chart that has key points. As he talks, camera cuts to chart.
CG:
CFIT Escape Manuever

Based on extensive simulator studies, we've found that unless daylight visual verification is made that no hazard exists, the proper C-F-I-T escape maneuver is:
...React immediately to a G-P-W-S warning without hesitation.
...Positively apply max thrust and rotate to the appropriate pitch attitude for your airplane.
...Pull up with wings level to ensure maximum airplane performance.
... Always respect stick shaker.

64. WS sim of Dave/Rob executing escape manuever.

Disclaimer bullet:
CONSULT YOUR AIRPLANE MANUAL FOR THE EXACT MANEUVER.

65. WS inside full-flight sim as student pilots correctly perform CFIT avoidance.	***(Ambient sound of crew inside simulator performing CFIT avoidance)***
66. Footage of enhanced GPWS use. Ambient audio: "Terrain, terrain! Pull…."	**The near future will see the installation of Enhanced G-P-W-S. This technology uses a database that includes the terrain around all major airports. Incorporating this terrain modeling with the current state-of-the-art G-P-W-S will enable the pilot to receive both aural and visual warnings much sooner than with current equipment.**
67. CG: **SUMMARY** **Standardized Regulations**	**Let's review the major points of this program. We need to reduce C-F-I-T accidents. All of us can help. Worldwide regulations governing flight should be standardized.**
68. Inside 767 SAS in flight.	**This will allow aircrews to be familiar with procedures and approach charts, no matter where they are in the world.**
69. International footage. CG: **Standard Operating Procedures**	**Operators throughout the world must make sure that their standard operating procedures are correct, up to date, and understood by those that use them.**
70. ATC room. CG: **ATC Improvements**	**Air traffic control systems must continue to be upgraded. A-T-C controllers and aircrews must ensure that clearances are understood.**
71. In flight. CG: **Vertical and Horizontal Situational Awareness**	**Aircrews must be constantly aware of the factors that can lead to a C-F-I-T accident. Some of these factors are: lack of both vertical and horizontal situational awareness.**

72. Inflight. CG: **Improved Communication** CG: **Altimeter Awareness**	**Communication errors between A-T-C and the crew. Ultimately, the pilot is responsible for terrain avoidance. Be aware of barometric altimeter setting errors.**
73. CU of nav setup. CG: **Correct Navigation Radios**	**Always cross-check your position and know the navigational radio setup. Many accidents occur because the wrong nav aid is set in the radios.**
74. Flight deck. CG: **Autoflight Modes Correct and Engaged**	**Even with the state-of-the-art electronics and autopilots, remember, they are only machines. Cross-check them!**
75. **Classroom.** CG: **Training**	**Training is the best way to make the crews aware of the C-F-I-T problem and to give them the knowledge to recognize a problem and get out of the situation.**
76. Flight deck. CG: **Study and Brief Departures and Arrivals**	**Study and brief both the departure and arrival. Make sure everyone involved understands what is planned. Any deviations to the briefing should be immediately questioned.**
77. CU of altimeter on plate. CG: **Cross-check Altitudes and Distances**	**Always cross-check altitudes and positions. Know where you are and what altitude is safe.**
78. Crew. CG: **Timely Communication**	**Good crew communication and callouts are essential.**

79. CU of nav radio. CG: **Monitor Navigation Radios**	**Check the navigational radios.**
80. WS flight deck. CG: **React Immediately to a GPWS Warning**	**Unless daylight visual verification is made that no hazard exists, react immediately to a G-P-W-S warning without hesitiation.**
81. CG: **Apply Maximum Thrust**	**Apply maximum thrust.**
82. CG: **Rotate Airplane to Proper Attitude**	**Rotate the airplane to a pitch attitude recommended by the airplane manufacturer.**
83. CG: **Pull Up Wings Level**	**Pull up with wings level.**
84. CG: **Always Respect Stick Shake**	**Always respect stick shaker. New technological advances are on the horizon, and more will follow.**
85. On-Camera talent at Hurricane Ridge, Olympic Mountains. CFIT accident site in distance.	***(On-camera talent)*** **By now, you should be aware of the C-F-I-T traps and some ways to avoid becoming a victim of a C-F-I-T encounter. All of us in the aviation industry can contribute to solutions. Effective C-F-I-T training is essential! Together, the aviation community can eliminate Controlled Flight into Terrain accidents.**
86. Same site of CFIT accident as used in opening: Hurricane Ridge, Olympic Mountains.	***(Music up)*** ***Credits*** ***(Fade to black)*** ***Credits***